

*March 23, 1854.*

Colonel SABINE, R.A., Treas. and V.P., in the Chair.

The following paper was read :—

“ Note on an indication of depth of Primæval Seas, afforded by the remains of colour in Fossil Testacea.” By EDWARD FORBES, F.R.S., Pres. G.S. &c. Received March 22, 1854.

When engaged in the investigation of the bathymetrical distribution of existing mollusks, the author found that not only did the colour of their shells cease to be strongly marked at considerable depths, but also that well-defined patterns were, with very few and slight exceptions, presented only by testacea inhabiting the littoral, circumlittoral and median zones. In the Mediterranean only one in eighteen of the shells taken from below 100 fathoms exhibited any markings of colour, and even the few that did so, were questionable inhabitants of those depths. Between 35 and 55 fathoms, the proportion of marked to plain shells was rather less than one in three, and between the sea-margin and 2 fathoms the striped or mottled species exceeded one-half of the total number.

In our own seas the author observes that testacea taken from below 100 fathoms, even when they were individuals of species vividly striped or banded in shallower zones, are quite white or colourless. Between 60 and 80 fathoms, striping and banding are rarely presented by our shells, especially in the northern provinces ; and from 50 fathoms shallow-wards, colours and patterns are well marked.

The relation of these arrangements of colour to the degrees of light penetrating the different zones of depth, is a subject well worthy of minute inquiry, and has not yet been investigated by natural philosophers.

The purpose in this brief notice is not, however, to pursue this kind of research, but to put on record an application of our knowledge of the fact that vivid patterns are not presented by testacea living below certain depths, to the indication of the depth, within certain limits, of palæozoic seas, through an examination of the traces of colour afforded by fossil remains of testacea.

Although their original colour is very rarely exhibited by fossil shells, occasionally we meet with specimens in which, owing probably to organic differences in the minute structure of the coloured and colourless portions of the shell, the pattern of the original painting is clearly distinguished from the ground tint. Not a few examples are found in Mesozoic as well as in Tertiary strata, but in all the instances on record, the association of species, mostly closely allied to existing types, and the habits of the animals of the genera to which they belong, are such as to prevent our having much difficulty about ascertaining the probable bathymetrical zone of the sea in which they lived.

But in palæozoic strata the general assemblage of articulate, molluscan and radiate forms is so different from any now existing with which we can compare it, and so few species of generic types still remaining are presented for our guidance, that in many instances we can scarcely venture to infer with safety the original bathymetrical zone of a deposit from its fossil contents. Consequently any fact that will help us in elucidating this point becomes of considerable importance.

Traces of colouring are rarely presented by palæozoic fossils, and the author knows of few examples in which they have been noticed. Professor Phillips, in his 'Geology of Yorkshire,' represents the carboniferous species, *Pleurotomaria flammigera* (i. e. *carinata*) and *conica*, as marked with colour, and Sowerby has figured such markings in *P. carinata* and *P. rotundata*. In the excellent monograph of the carboniferous fossils of Belgium, by Professor De Koninck of Liège, indications of pattern-colouring are faintly shown in the figures of *Solarium pentangulatum*, and distinctly in those of *Pleurotomaria carinata* and *Patella solaris*.

In the cabinets of the Geological Survey of Great Britain are some finely-preserved fossils from the carboniferous limestone of Parkhill, near Longnor in Derbyshire. Among these are several

that present unmistakeable pattern-markings, evidently derived from the original colouring. They are—

*Pleurotomaria carinata* and *conica*, showing wavy blotches, resembling the colouring of many recent *Trochidæ*.

An undescribed *Trochus*, showing a spiral band of colour.

*Metoptoma pileus*, and

*Patella* ? *retrorsa*, both with radiating stripes, such as are presented by numerous existing *Patellidæ*.

*Natica plicistria*, with broad mottled bands.

*Aviculo-pecten*, a large unnamed species, with spotty markings on the ribs in the manner of many existing *Pectines*.

*Aviculo-pecten sublobatus*, Ph. ? Beautifully marked with radiating, well-defined stripes, varying in each individual, and resembling the patterns presented by those recent *Aviculæ* that inhabit shallows and moderate depths.

*Aviculo-pecten intercostatus* and *elongatus* also exhibit markings.

*Spirifer decorus* and *Orthis resupinata*, show fine radiating white lines.

*Terebratula hastata*, with radiating stripes.

The analogy of any existing forms that can be compared with those enumerated, would lead to the conclusion that the markings in these instances are characteristic of mollusks living in a less depth of water than 50 fathoms. In the case of the *Terebratula*, which belongs to a genus the majority of whose living representatives inhabit deep water, it may be noticed that all the living species exhibiting striped shells are exceptions to the rule, and come from shallow water.

There are many circumstances which warrant us to suspect that the carboniferous mountain limestone of most regions was a deposit in shallow water. The facts now adduced materially strengthen this inference.

In the British Museum there is a beautifully spotted example of a Devonian *Terebratula*, brought by Sir John Richardson from Boreal America.

Specimens of the *Turbo rupestris*, from the Lower Silurian Limestone of the Chair of Kildare near Dublin, exhibit appearances that seem to indicate spiral bands of colour.